

The Sensitivity of the Global Water and Energy Cycles: An Integrated Assessment of Models and Observations

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Project hypothesis:

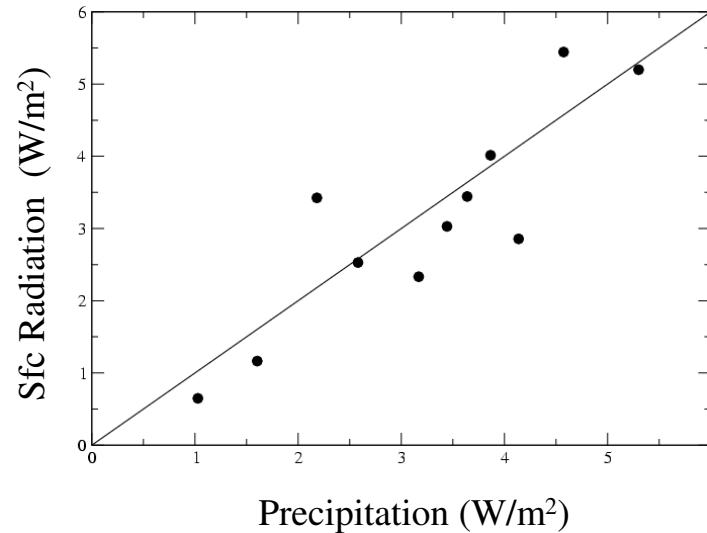
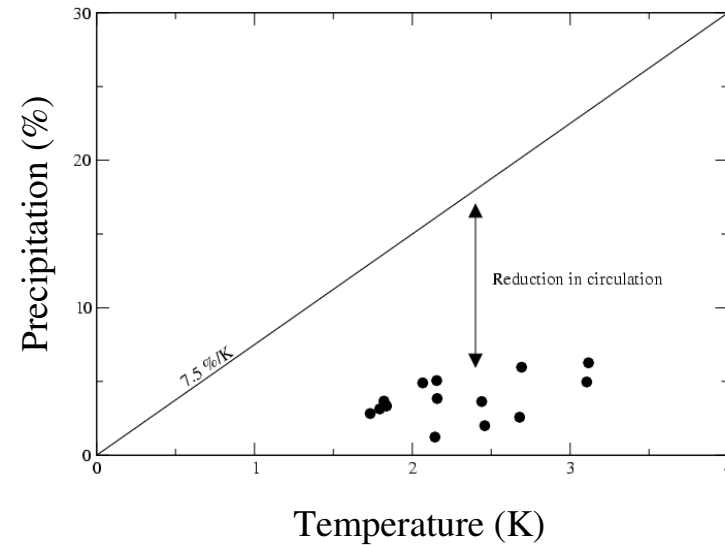
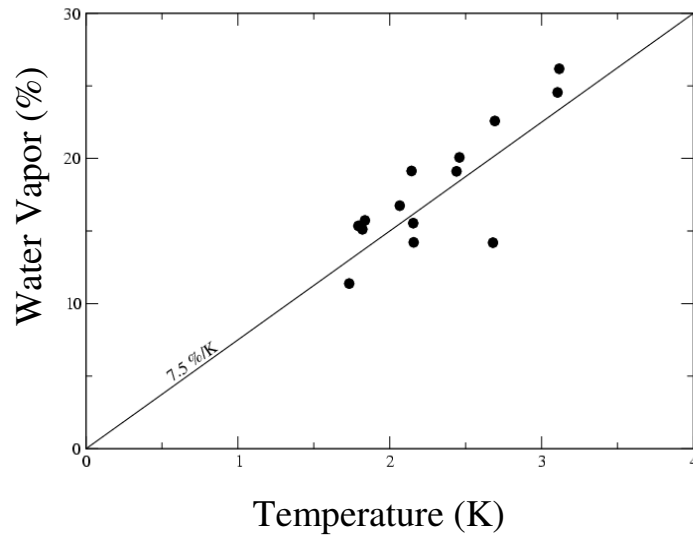
To use satellite-observed variability in the global energy and water cycles to constrain climate model projections of the hydrologic sensitivity.

Objectives & deliverables:

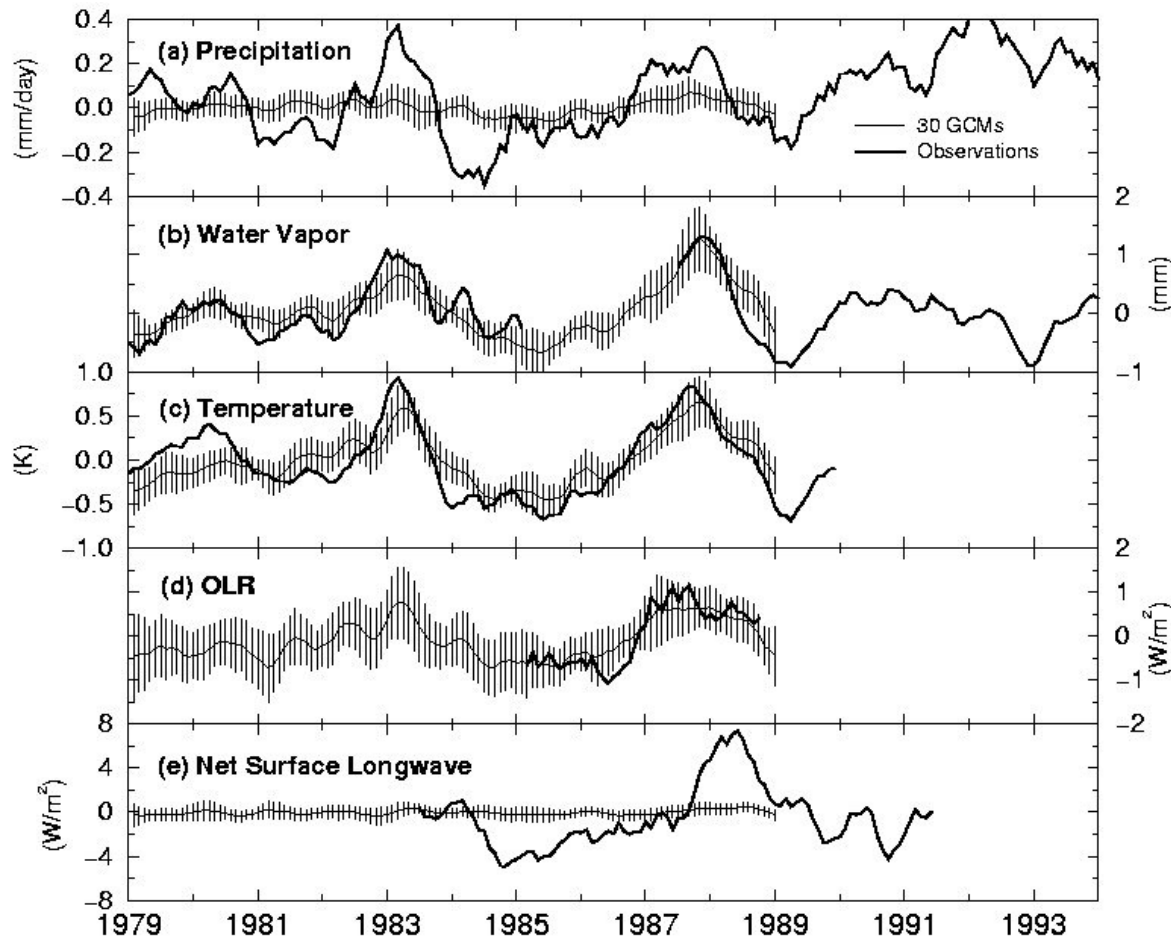
An assessment of:

- the mechanisms which govern low-frequency changes in the intensity of the hydrological cycle;
- the coupling between variations in the hydrologic and energy cycles;
- the relation between changes the hydrological cycle and extreme precipitation events;
- the ability of global climate models to simulate the observed variations and interactions.

The Sensitivity of the Global Hydrological Cycle to Increasing CO₂: IPCC AR4 GCMs

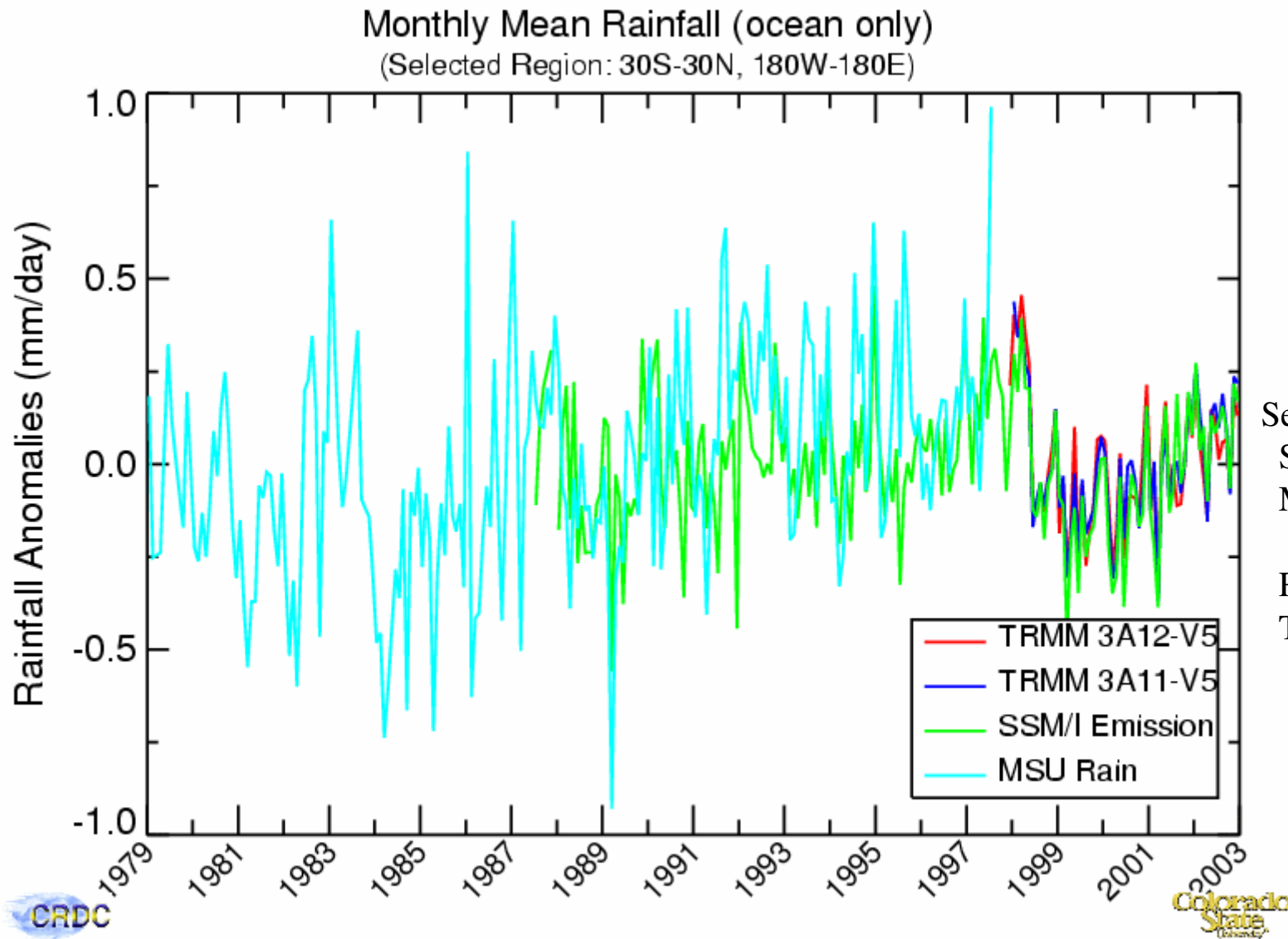


Technical approach and/or methods: Comparison of Observed and GCM-Simulated Variability



Soden (2000)

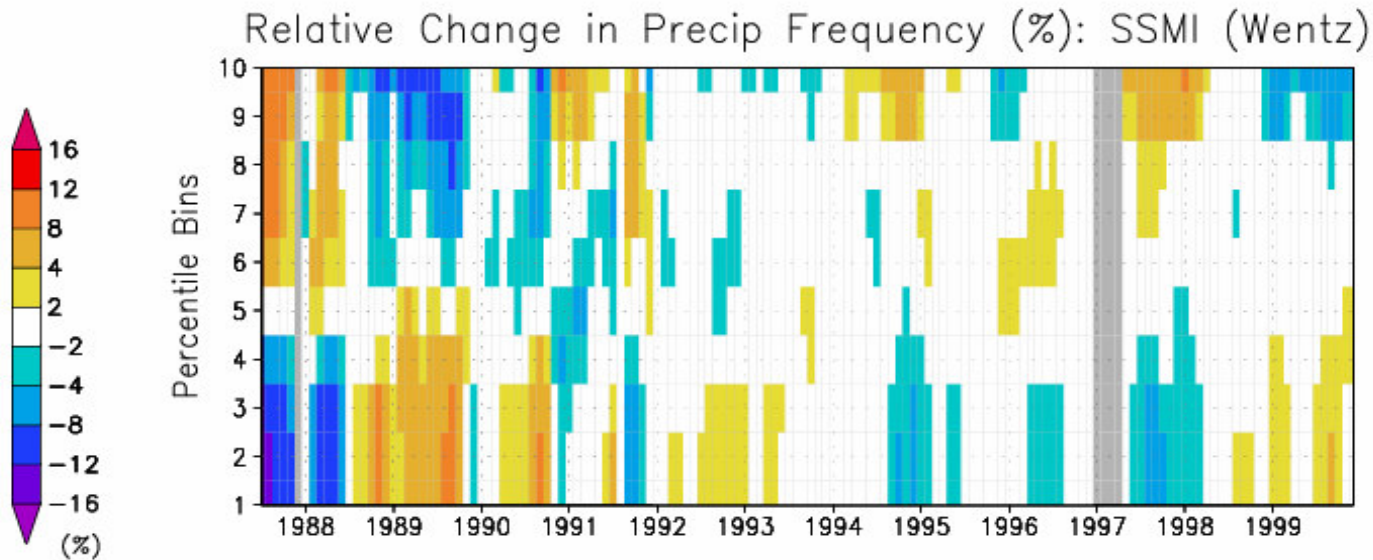
**Technical approach and/or methods:
Consistency across multiple algorithms / data sets / variables**



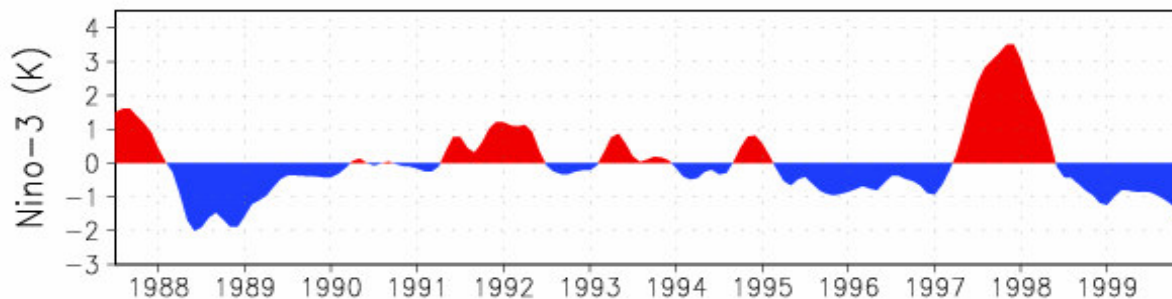
See Also:
Spencer et al.
MSU scattering

Robertson et al.
TRMM/PR SRT

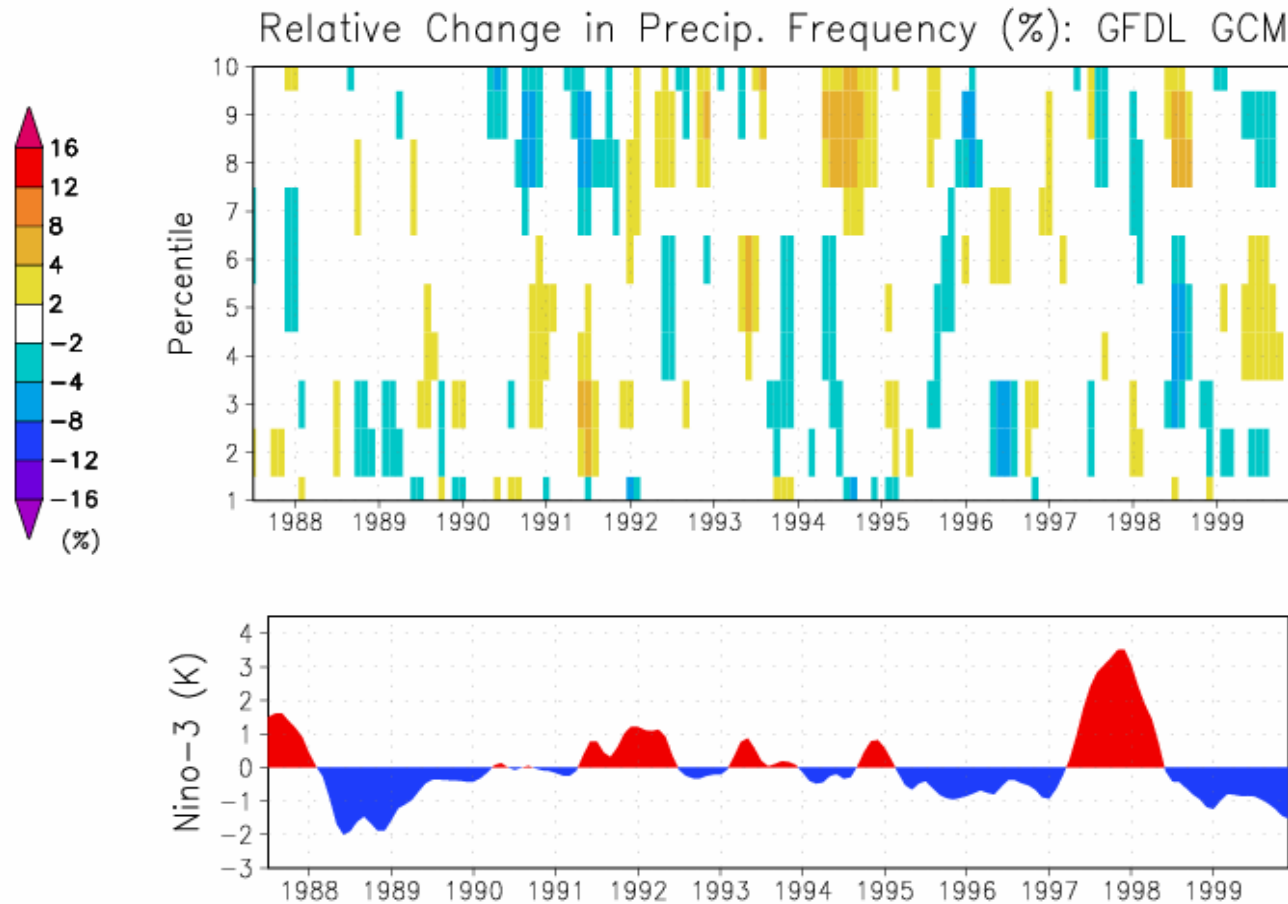
Technical approach and/or methods: Relation between hydrologic variability and precipitation extremes



- El Nino (warm)
Increase heavy precip
Decrease light precip
- La Nina (cold)
Decrease heavy precip
Increase light precip



Technical approach and/or methods: Evaluation of models



- Little coherent variability in GCM simulated PDF.

Data set needs:

- precipitation
- evaporation
- column water vapor
- profiles of temperature, moisture, clouds?
- radiative fluxes – surface, TOA, vertical profiles?

Project outputs:

- integrated assessments of water and energy cycle variability from satellite observations
- model-simulation of microwave radiances from CRM/GCM simulations for retrieval evaluation
- composites of environmental conditions associated with extreme precipitation events
- evaluation of climate model simulated variability
- improved statistical retrievals of surface longwave from microwave/IR radiances

Potential collaborations (with NSIT, other NEWS projects, etc.) :

- Precipitation retrieval: Adler, Olson
- Surface Fluxes: Curry
- Radiation/Cloud: Wielicki
- Water Vapor: Fetzer, Wentz
- Integrated Analyses: Bosilovich, L'Ecuyer, Liu, Roads

Important outside linkages/resources (outside the NEWS team) :

- Ongoing collaborations with NOAA/GFDL.
- Interactions with broader climate modeling community (NCAR, UKMO, BMRC, LMD, IPCC AR4 ..)
 - Access to a broad range of models w/ highly contrasting radiative/hydrologic sensitivities.
- NSF Climate Process Team (convection, cloud, radiation feedbacks over tropics)
- NOAA/NCDC precipitation/radiation assessments

Expected contribution to the NEWS objective:

- Assessment of consistency between related hydrologic and energy budget measurements.
- Improved understanding of the discrepancy between modeled and observed hydrologic variability.
- Observational constraints for model simulations of the global hydrological cycle sensitivity and the processes which determine that sensitivity.
- Assessment of the relevance of observed hydrologic variability to 2xCO₂ hydrologic sensitivity.
- Improved understanding of the dynamic/thermodynamic environments associated with extreme precipitation events.

Issues, needs, and concerns:

- Need precipitation retrieval expertise.
- Prefer multiple, independent retrievals, rather than a single “merged” product.